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DATE: Monday, June 27, 2005

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END OF SEARCH HISTORY

\* NOTICES \*

Translation of JP 7-263995  
(cited by Applicants)

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Industrial Application] This invention relates to the surface acoustic wave equipment constituted including the surface acoustic wave resonator and the inductance component, and the antenna splitter which equipped the list with this surface acoustic wave equipment.

#### [0002]

[Description of the Prior Art] Since surface acoustic wave equipment can apply a photolithography technique, and can manufacture it like LSI (large-scale integrated circuit) currently produced very in large quantities and it is excellent in mass-production nature, it is broadly used with a public welfare device, communication equipment, etc. Especially, recently, it is used as a high pass filter in mobile communications, such as a pocket bell and a cellular phone, in many cases from the description that surface acoustic wave equipment is small and that it is lightweight.

[0003] The equipment which constituted the surface acoustic wave equipment used by said mobile communications using the IIDT (Interdigitated Interdigital Transducers) mold filter or the surface acoustic wave resonator since steep frequency characteristics were required especially by low loss is used.

[0004] As an example of the surface acoustic wave equipment constituted using the above surface acoustic wave resonators, there is a technique the Institute of Electronics, Information and Communication Engineers technical research report US 92-52 (1992-09) and given in 9th page - 16 page. As shown in below-mentioned drawing 3, this technique uses a surface acoustic wave resonator for the serial of a ladder mold filter, and a juxtaposition component, and constitutes a band pass mold filter.

[0005] Moreover, it is electronics as other techniques. Letter Like 21 volumes, No. 25/26, and the 1211-1212nd page (ELECTRONICS LETTERS 5th December 1985, Vol.21, No.25/26, pp.1211-1212) publication, an inductance is used for the serial component of a ladder type filter, a surface acoustic wave resonator is used for a juxtaposition component, and there will be a technique which constitutes a filter in 1985.

[0006] If an inductance component is used for the serial component of a ladder type filter, a surface acoustic wave resonator is used for a juxtaposition component and it constitutes from what uses an inductance for the serial component of this ladder type filter, uses a surface acoustic wave resonator for a juxtaposition component, and constitutes a filter as shown in below-mentioned drawing 2, the frequency characteristics of a ladder type filter will turn into the property of a low pass mold of having an inhibition zone within passage as shown in drawing 4. In addition, also about the case where it constitutes as single functional equipment combining two or more surface acoustic wave resonators, or a surface acoustic wave resonator and other electric elements as mentioned above, by this invention, this is caught in large semantics and it is called surface acoustic wave equipment.

[0007] The above surface acoustic wave equipments of a configuration are used as a filter for transmission of an antenna splitter in the portable telephone. In order for a single antenna to perform transmission and reception of an electric wave, an antenna splitter serves to separate a sending signal and an input signal, and the subject constitutes the outline, the filter for transmission, and the filter for reception. Therefore, with the surface acoustic wave equipment of this invention which is a filter for

transmission, as shown in drawing 4 , the frequency of a sending signal will be equivalent to Passband T, and the frequency band of an input signal will be equivalent to the rejection band region R. Moreover, in order to oppress the undesired signal of higher harmonics, such as a double frequency, it is the filter of a low pass property. For example, in the cellular phone of the digital method currently used at home, the transmitting band is set to the high-frequency side of a receiving band, and said surface acoustic wave equipment is used for the antenna splitter of such an application.

[0008]

[Problem(s) to be Solved by the Invention] By the way, it is important for the filter for transmission for there to be un-arranging [ which the power consumption of a portable telephone increases ], when loss is large, and to opt for the configuration of a component or equipment with said surface acoustic wave equipment in consideration of loss of a pass band, the magnitude of attenuation of a high-frequency region, etc. in order to transmit the big sending signal in power. However, since the application by which the loss and the magnitude of attenuation like a cellular phone are made a problem by the RF more than a UHF band was not made, as for conventional surface acoustic wave equipment, consideration especially to a RF property was not carried out about the configuration of a component.

[0009] That is, with said surface acoustic wave equipment, electrical properties, such as a surface acoustic wave resonator and an inductance component, can be concerned with the number properties of rounds, such as propagation loss, a mismatch loss, and a cut off frequency, and can determine an electrical property with each optimal component from the specification of these frequency characteristics conversely. However, it turned out that there is a problem that actual surface acoustic wave equipment is not enough as the magnitude of attenuation of a high-frequency region if equipment is constituted for low loss-ization on importance, and steep frequency characteristics are not acquired. In addition, as this kind of surface acoustic wave equipment or a surface acoustic element, although JP,55-33382,A, JP,1-73807,A, and a thing given in JP,5-114828,A were known, neither was taken into consideration especially about the property in a high-frequency region.

[0010] This invention was made in view of such a conventional trouble, and that purpose is in improving the frequency characteristics in the high-frequency region of this kind of surface acoustic wave equipment.

[0011]

[Means for Solving the Problem] The 1 opening surface acoustic wave resonator which, as for this invention, comes to form a blind-like electrode on a piezoelectric substrate in order to attain said purpose, The inductance component which consists of a microstrip line formed on the dielectric substrate, In the surface acoustic wave equipment with which wiring which connects electrically these 1 opening surface acoustic wave resonator, an inductance component, and the terminal of a package mutually was stored in the single package, it constituted so that the dielectric substrate of said inductance component might be six or less specific inductive capacity substantially.

[0012]

[Function] In the surface acoustic wave equipment of the low pass mold which used the inductance component for the serial component of a ladder type filter, and used the surface acoustic wave resonator for the juxtaposition component, it is decided by the braking capacity of surface acoustic wave \*\*\*\*\*\*, the inductance value of an inductance component, etc., these components value is chosen, and the magnitude of attenuation of a high-frequency region can improve the magnitude of attenuation. However, in such a remedy, the increment in loss of a pass band will be caused conversely, and the fundamentality ability of equipment will be obtained. Then, as a result of working on the remedy of the magnitude of attenuation which does not produce the increment in loss of a pass band, it turned out that the inductance component is carrying out important work.

[0013] That is, the above components for surface acoustic wave equipments are carefully created by the electric resistance in a RF, and, generally the advantageous component which formed the microstrip line in the shape of a spiral on the insulating substrate is used in respect of assembly or cost as an inductance component. When surface acoustic wave equipment was constituted from such an inductance component, the thickness of the insulating substrate of an inductance component and the magnitude of the magnitude of attenuation of a high-frequency region have correlation, and the inclination for the magnitude of attenuation to become large in a thicker substrate was seen. This is idea \*\* when it originates in the magnitude of the parasitic capacitance of an inductance component being the electrical

property from which the component differed as a result depending on the thickness of a substrate.

[0014] Since the thickness of equipment itself will increase, it is inconvenient to use a thick substrate for an inductance component, in order to improve the magnitude of attenuation of the high-frequency region of surface acoustic wave equipment. Then, this invention constituted surface acoustic wave equipment by the inductance component for which specific inductive capacity used the small substrate in order to acquire the same effectiveness as a thick substrate. Thus, if a substrate with small specific inductive capacity is used for an inductance component, the effect of stray capacity becomes small, and the magnitude of attenuation of the high-frequency region of surface acoustic wave equipment can be improved, and it will become possible to acquire steep frequency characteristics.

[0015]

[Example] Hereafter, the example of this invention is explained with reference to a drawing. Drawing 1 is the perspective view showing the configuration of the surface acoustic wave equipment concerning the 1st example of this invention. In drawing, the surface acoustic wave resonator 1 forms a majority of a pair of blind-like electrodes 3 in the front face of the piezoelectric substrate 2 with an aluminum thin film etc., and is constituted as a 1 opening surface acoustic wave resonator. The inductance component 4 forms the microstrip line 6 by the copper thin film on the quartz-glass substrate 5, and is constituted. In addition, the thin film of nickel and gold is formed in the copper thin film front face for improvement in protection and wirebonding nature.

[0016] It is fixed to the same package 7 with adhesives, and an aforementioned surface acoustic wave resonator and an aforementioned inductance component are connected with the terminal 9 of mutual or a package with the wiring wires 8, such as aluminum. In fact, although the seal of the package is carried out, it has abbreviated to a internal structure being known by a diagram.

[0017] Drawing 2 is the electrical diagram of the surface acoustic wave equipment concerning an example. As shown in this drawing, the surface acoustic wave equipment concerning an example constitutes the ladder mold filter as mentioned above, and this equipment shows the low pass mold filter shape it is decided from the value of the braking capacity of the surface acoustic wave resonator 1, and the value of the inductance component 4 that a cut off frequency will be. Moreover, since the transmission coefficient of a circuit turns into the real number, near the resonance frequency of the surface acoustic wave resonator 1 will show a damping property, and a rejection band region will be formed.

[0018] The inductance component 4 which used quartz glass as the substrate is used, and surface acoustic wave equipment 1 consists of this example. Thereby, the frequency characteristics of equipment are improvable so that it may explain below.

[0019] The frequency characteristics a of conventional surface acoustic wave equipment and the frequency characteristics b of the surface acoustic wave equipment applied at this example are shown in drawing 5. Conventional surface acoustic wave equipment constitutes equipment using the inductance component which used the alumina as the substrate, and the specific inductive capacity of an alumina is 8.5. On the other hand, in this example, quartz glass is used for a substrate and specific inductive capacity is 1/2 or less compared with 3.8 and the conventional alumina substrate. therefore, it is thought that the effect affect the inductance of stray capacity is boiled markedly, and is small. As shown in this drawing, compared with the former, the magnitude of attenuation in a high-frequency region improves, and the property also with steep frequency characteristics is actually acquired.

[0020] Here, the following was found as a result of investigating about the electrical property of an inductance component. Drawing 6 is the perspective view showing the basic structure of the inductance component 4, and the electrical equivalent circuit can be drawn like drawing 7. It is C1 in this equal circuit. The capacity and C2 which microstrip line 6 the very thing has It is earth capacity and C1 is C2. It is so small that it can compare and ignore, and most stray capacity of the inductance component 4 is earth capacity C2. It is decided.

[0021] Drawing 8 is the Smith chart of the impedance which the inductance linked to a serial shows to system of measurement. When it is in an ideal condition without the effect of stray capacity or resistance, the impedance moves to high frequency toward the point of impedance infinity along with the broken line shown in this drawing from low frequency. However, in the actual inductance, effect of stray capacity cannot be disregarded, but it will separate from the inductance value of an ideal, so that it becomes high frequency. The inductance component of the conventional alumina substrate shows

impedance change as shown in this drawing A, and the gap from the ideal condition of the inductance value in a RF is large. On the other hand, with the inductance component 4 of this example using a quartz-glass substrate, as shown in this drawing B, the RF was also found by that a gap of an inductance value is comparatively small and it is close to an ideal condition.

[0022] As mentioned above, although surface acoustic wave equipment was constituted from the 1st example, using quartz glass as a substrate 5 of the inductor wardrobe component 4, it is characterized by this invention making specific inductive capacity of a substrate a small thing, and it is also possible to use other substrate ingredients. For example, specific inductive capacity of silica glass is 3.8, and the specific inductive capacity of 4.8 and barium borosilicate glass is 5.8, specific inductive capacity is using it for the surface acoustic wave equipment with which this invention's is concerned by all, and an improvement of the frequency characteristics in a high-frequency region is possible for borosilicate glass.

[0023] Furthermore, as mentioned above, when it was going to make stray capacity small with the conventional alumina substrate, thickness of a substrate had to be thickened, for this reason, the whole surface acoustic wave equipment became thick, and it was disadvantageous for the miniaturization of equipment. However, if a substrate ingredient with a small dielectric constant is used like this example, it is not necessary to thicken a substrate 5 and is very advantageous to the miniaturization of surface acoustic wave equipment.

[0024] The configuration of the surface acoustic wave equipment by the 2nd example of this invention is shown in drawing 9. Concave processing was performed to the ground-plane side of a substrate 5, and crevice 5a was formed, and in order to reduce the stray capacity which the inductance component 4 has, it constituted from this example so that not only the substrate 5 but an air space might intervene between a ground plane and the conductor of a microstrip line 6.

[0025] Earth capacity C2 in the equal circuit of the inductance component previously shown in drawing 7 by considering as such structure It becomes the value decided by the dielectric constant, thickness, and air layer thickness of a substrate 5, and effectual specific inductive capacity can be made small.

[0026] As stated above, performing concave processing and forming crevice 5a will reduce the stray capacity which the inductance component 4 has, therefore its property of the inductance component 4 can improve like the 1st above-mentioned example, and an improvement of the frequency characteristics in the high-frequency region of surface acoustic wave equipment can be aimed at. Moreover, in this 2nd example, the property is improved by processing it into a substrate 5, it is usable and there is an advantage from which the degree of freedom to a substrate ingredient is obtained with an ingredient with comparatively big specific inductive capacity, for example, the conventional alumina substrate.

[0027] Drawing 10 is the perspective view showing the configuration of the surface acoustic wave equipment concerning the 3rd example of this invention. Although adhesion immobilization of the two inductance components 4 was carried out separately at the package, this 3rd example forms two inductance components 4 on one quartz-glass substrate 5, and constitutes surface acoustic wave equipment from the 1st above-mentioned example. Thus, if two or more inductance components 4 are formed on the single substrate, the trouble at the time of assembling surface acoustic wave equipment can be reduced.

[0028] Drawing 11 is the perspective view showing the structure of the surface acoustic wave equipment of the 4th example which applied it when depending the same approach as the 3rd above-mentioned example on concave processing of the ground plane of the substrate 5 of the inductance component 4. In the case of this example, the same effectiveness as the 3rd example is acquired by crevice 6a.

[0029] Drawing 12 is the perspective view showing the structure of the surface acoustic wave equipment concerning the 5th example of this invention. the microstrip line 6 of the inductance component 4 according to the quartz-glass substrate 5 at this example, and the common electrode of the surface acoustic wave resonator 1 -- respectively -- a part -- it serves also as wiring, and by considering as such structure, the wiring part with a wire decreases and has effectiveness, such as reduction of activity trouble, and reduction of the defect by wiring mistake. Also in concave processing explained in the 2nd example, the structure of this example can be applied, and can acquire the same effectiveness.

[0030] The value of the effectual specific inductive capacity at the time of performing concave processing to the specific inductive capacity of the substrate 5 usable for the inductance component 4 or a substrate 5 here, and forming crevice 5a, although the configuration of the surface acoustic wave

equipment concerning this invention was above is the following, and can specifically be made and decided.

[0031] That is, if the relation between the magnitude of attenuation in the double frequency of transmit frequencies and the specific inductive capacity of an inductance substrate is drawn as the magnitude of attenuation of a high-frequency region about the case where thickness of a substrate 5 is set constant by 0.5mm, the graph shown in drawing 13 will be obtained. Since the specification of the loss in this double frequency is 30dB or more, things understand the specific inductive capacity or the effectual specific inductive capacity of the substrate 5 used for the inductance component 4 from the graph of this drawing that what is necessary is just six or less.

[0032] Drawing 14 is an example at the time of using the surface acoustic wave equipment 1 of this invention for an antenna splitter, a sign 10 shows an antenna splitter and a sign 11 shows an antenna, respectively. In addition, this antenna splitter 10 consists of a transmitting filter and a receiving filter. Moreover, in Sign T, a sending signal and Sign R show an input signal like the above-mentioned. Thus, if constituted, since the magnitude of attenuation of a high-frequency region can be enlarged for the above-mentioned reason, the engine performance of the antenna sect machine 10 improves.

[0033]

[Effect of the Invention] Invention according to claim 1 which made the dielectric substrate of an inductance component six or less specific inductive capacity by old explanation so that clearly, Invention according to claim 2 in which the dielectric substrate was formed including at least one of quartz glass, silica glass, borosilicate glass, and the barium borosilicate glass, According to invention according to claim 3 which made effectual specific inductive capacity of the dielectric substrate of an inductance component six or less, and invention according to claim 4 which formed the crevice in the ground-plane side of a dielectric substrate And according to invention according to claim 5 which was equipped with two microstrip lines and formed on one common dielectric substrate Since the specific inductive capacity of a dielectric substrate can become six or less substantially, and all can make small effect of the stray capacity in a high-frequency region and can raise the steepness and/or the magnitude of attenuation of frequency characteristics, the frequency characteristics in the high-frequency region of surface acoustic wave equipment are improvable. Moreover, in addition to said effectiveness, reduction of the number of assemblers can be aimed at in invention according to claim 5.

[0034] According to invention [ equipped with claim 1 thru/or surface acoustic wave equipment given in five ] according to claim 6, it becomes possible to aim at improvement in the engine performance of an antenna splitter for said reason, and further, since a substrate can also be made thin, it can constitute in small.

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[Translation done.]